Memorandum

Michael Lindgren
Chief Accelerator Officer

Accelerator Division
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Batavia, Illinois 60510-5011
USA
Office: 630.840.8409
mlindgre@fnal.gov

Date: November 20, 2020

To: Todd Sullivan

From: Mike Lindgren Michael Lindgren, UID:mlindgre Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.11.20 10:07:08 -06'00'

Re: Approval for Running NuMI

Safety documentation and procedures for restart of NuMI are now complete and in place. Therefore, you are hereby authorized to run beam to NuMI.

cc: M. Convery
P. Czarapata
G. Annala
E. McHugh
M. Schoell

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BEAM PERMIT
11/20/2020

NuMI Accelerator Safety Envelope (ASE) Limit

The maximum beam intensity transmitted through the NuMI Beamline is limited to:
7.45×10^{17} protons/hr up to 120 GeV.

No accelerator or beam line will transmit beam without an operational beam interlock safety system.

NuMI Beamline Operating Limits

The maximum beam intensity transmitted through the NuMI Beamline is limited to:
2.25×10^{17} protons/hr up to 120 GeV.

Examples: Charge/hr = number of pulses/hr x number of protons/pulse

#1 1,925 pulses per hour at 1.17×10^{14} protons per pulse = 2.25×10^{17} protons per hour.

Special conditions and comments:

Reviewed by Todd Sullivan — Digitally signed by Todd Sullivan Date: 2020.11.20 10:13:38 -06'00'
Operations Department Head

Reviewed by Thomas R. Kobilarcik — Digitally signed by Thomas R. Kobilarcik Date: 2020.11.20 10:07:18 -06'00'
Systems Department Head

Reviewed by Madelyn Schoell, UID:maddiew — Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.11.20 10:03:04 -06'00'
Assigned RSO

Reviewed by Madelyn Schoell, UID:maddiew — Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.11.20 10:02:50 -06'00'
ESH Radiation Physics Operations Department Head

Approved by Michael Lindgren, UID:mlindgre — Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.11.20 10:17:33 -06'00'
Accelerator Division Head

Operator Signatures

Crew Chiefs

11/20/20

11/20/20

11/21/20

21 Nov 20

Crew A

11/2/20

11-21-20

11-21-20

11/21/2020

11-22-20

Crew B

Crew C

11/21/20

11/20/20

11/20/20

Crew D

11/21/20

11-21-20

11/21/20

11/21/20

Crew E

11/20/20

20 Nov 2020

Other

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ADAP-11-0001
REV. 9

SYSTEM START-UP SIGN-OFF

The signatures below, unless noted in the comments section, indicate that the relevant systems are ready for the restart of beam operation. Indicate in the comments section any remaining work that would affect the restart of beam operations. Indicate N/A for departments that did not do any work on the system.

SYSTEM BEING SIGNED OFF: (Circle as Applicable)
Linac NIF MTA Booster [8-GeV Line-MI-10 Region]
[MI-20-MI-62/Recycler] BNB (NuMI) P1-P2 Muon P3-Switchyard
Meson Primary MT MC NM FAST _____

DEPARTMENT	DATE	SIGNATURE (Department Head/Designee)
1. Controls	11/16/20	James Patrick — Digitally signed by James Patrick Date: 2020.11.16 11:23:55 -06'00'
2. Cryogenics	N/A	
3. E/E Support	11/19/20	Chris Jensen — Digitally signed by Chris Jensen DN: cn=Chris Jensen, o, ou=Fermilab, email=cjensen@fnal.gov, c=US Date: 2020.11.19 15:27:28 -06'00'
4. RPO Manager	11/20/20	Madelyn Schoell, UID:maddiew — Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.11.20 10:00:48 -06'00'
5. LSO	N/A	
6. External Beamlines	11/20/20	Thomas R. Kobilarcik — Digitally signed by Thomas R. Kobilarcik Date: 2020.11.20 09:45:34 -06'00'
7. Instrumentation	11/14/20	Craig Drennan — Digitally signed by Craig Drennan Date: 2020.11.14 13:39:57 -06'00'
8. Interlocks	11/19/20	Randy Zifko, UID:rmzifko — Digitally signed by Randy Zifko, UID:rmzifko Date: 2020.11.19 15:39:10 -06'00'
9. Main Injector	11/17/20	Ioanis Kourbanis, UID:ioanis — Digitally signed by Ioanis Kourbanis, UID:ioanis Date: 2020.11.17 09:42:01 -06'00'
10. Mechanical Support	11/19/20	
11. Muon	N/A	
12. Operations	11/04/20	
13. Proton Source	N/A	
14. RF	N/A	
15. ENG Support	10/29/20	
16. Target Systems	11/20/20	Bob Zwaska, UID:zwaska — Digitally signed by Bob Zwaska, UID:zwaska Date: 2020.11.20 09:34:26 -06'00'
17. Shutdown Coordinator	11/14/20	Consolato Gattuso — Digitally signed by Consolato Gattuso Date: 2020.11.14 17:35:38 -06'00'

Comments and special conditions (please mark comment with department # to connect comment with appropriate department):

* After Horn & Target scans, all the beamline components & shielding to be returned to final configuration". NSC

EES: Numi Kicker cooling skid not regulating, will work in manual only. MSD also investigating

The NuMI radiation shielding meets the requirements documented in the 2018 "Addendum to the NuMI Beam Line Shielding Assessment for 1MW Operation of NOvA Experiment" shielding assessment.

FINAL APPROVALS

System Department Head: Thomas R. Kobilarcik — Digitally signed by Thomas R. Kobilarcik Date: 2020.11.20 10:09:29 -06'00' — Date 11/20/20

Assigned RSO: Madelyn Schoell, UID:maddiew — Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.11.20 10:01:16 -06'00' — Date 11/20/20

AD Division Head: Michael Lindgren, UID:mlindgre — Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.11.20 10:12:48 -06'00' — Date 11/20/20

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Running Condition
NuMI

November 20, 2020

	Area RSO	Maddie Schoell
Mode of Operation	HEP Operation	
Beam Limits	**Beam Energy**	**ASE Limit** / **Operating Limit**
	120 GeV	7.45 E17 protons/hr / 2.25 E17 protons/hr
Critical Devices	I:LAM60, I:LAM61 & E:HV101A, E:HV101B	
Enclosures Protected	NuMI MI-65, NuMI Decay Pipe Passageway and NuMI MINOS Alcoves & Absorber Areas	
Preferred Monitoring Devices*	Intensity is monitored via E:TOR101	

*Other methods of monitoring intensity may be used.

Requirements

Access Devices	I:LAM60, I:LAM61 & E:HV101A, E:HV101B must be disabled in order to access the Carrier Tunnel, Pre-Target, Target Hall, Decay Pipe Region, Hadron Absorber & Muon Alcoves.
Cool Off Period	The following air monitors must be ≤ 400 cpm prior to accessing the following areas unless waived by the RSO or designee. PreTarget: EAV1 (G:RD1225), Target Hall: NuMI TH Air Mon ACCESS (G:RD1230). NuMI Decay Pipe: EAV2 TH Air Mon (G:RD1228) & EAV3 ABS Air Mon (G:RD1229). NuMI Absorber Hall: NuM ABS Air Mon (G:RD1242).
Special Interlocks	The CDC Inputs including failure mode devices may all be found on the Safety System Status pages. The 200 module Beam Permit System inputs are summed on page E39, the detailed inputs are on E40. All Target, Horns and Absorber RAW Beam Permit System inputs are required, masking or disabling requires approval from the machine Department and RSO or designee notification.
Special Concerns	Any work performed on critical devices or obtaining a critical device key requires prior RSO approval. If beam is disabled due to a genuine RAW system trip, prior RSO or designee approval is required before re-enabling beam. The dehumidifier system must be operating when beam enabled unless waived by the RSO or designee.
Gates, Fencing and Passive Shielding Requirements	There is no access to radiologically fenced areas without prior RSO approval. The shield wall between the MI-65 shaft area and Enclosure is required during operation. The associated roll-up door is locked with a RSO padlock. The concrete cover blocks across the top of the targeting and horn system are required and are also locked. Shielding, fencing and postings are in accordance with the 2018 "Addendum to the NuMI Beam Line Shielding Assessment for 1MW operation of NOvA Experiment".

Assigned RSO approval also signifies that all necessary Interlock Tests have been completed and Removable Shielding is installed.

ps. Dept. Head Approval	Todd Sullivan — Digitally signed by Todd Sullivan Date: 2020.11.20 10:14:16 -06'00'	**Assigned RSO Approval**	Madelyn Schoell, UID:maddiew — Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.11.20 10:03:47 -06'00'
Sys. Dept. Head Approval	Thomas R. Kobilarcik — Digitally signed by Thomas R. Kobilarcik Date: 2020.11.20 10:08:44 -06'00'	**AD Head Approval**	Michael Lindgren, UID:mlindgre — Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.11.20 10:16:56 -06'00'

Operational Comments

MCR must be appropriately staffed according to the Accelerator Safety Envelope.

Access to the MI-65 and the MINOS lower levels is acceptable. Access to MINOS ramp electronics racks upstream of Radiation Area ropes and downstream of Absorber Hall requires prior RSO approval. The Mechanical Room double doors are locked with a Radiation Safety key, and access requires RSO or designee approval.

Three Exhaust Stacks are monitored via ACNET on page D106 AIRMONs. pg. 2 as EAV1 (G:RD1225), EAV2 (G:RD1228), and EAV3 (G:RD1229). The air supply AHU-MI-65-4 runs at 1,000 cfm. The exhaust fan EAV2 runs at roughly 900 cfm. The exhaust fan EAV3 runs at about 750 cfm.

The SR3 fan/vent located in NuMI Target Hall needs to be turned off and the damper closed during NuMI beam operations. The damper is locked off with the M13 lock and requires RSO or designee approval to be opened.

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Running Condition
NuMI

November 20, 2020

Area RSO Maddie Schoell

Instrument Information

All detector trips shall be documented in the MCR E-log.
Interlocked detectors in "Rate" mode that trip require RSO approval before reset.

MUX	Type	Location	QF	R/I Mode	Trip Level	CDC	Device(s) Tripped
1-224	Scarecrow	MI-65 Hobbit Door*		Rate	50,000 mrem/hr	E:NUMCRD	I:Lam60, I:Lam61 & E:HV101 A, B
1-226	Chipmunk	MI-65 Horn Power Supply Room	5	Rate	5 mrem/hr	E:NUMCRD	I:Lam60, I:Lam61 & E:HV101 A, B

Note: QF only included for chipmmunks

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Running Condition
NuMI

November 20, 2020

Area RSO: Maddie Schoell

Operator Signatures

Crew Chiefs

11/20/20

11/20/20

11/24/20

21 Nov 20

Crew A

11/2/20

11-21-20

11-21-20

11/24/2020

11/22/20

Crew B

Crew C

11/21/20

11/20/2020

11/20/20

Crew D

11/21/20

11-21-20

11/21/20

11/2/20

Crew E

11/20/20

20 Nov 2020

Other